

CLAIMS:

1. Satellite radiodetermination apparatus,
comprising:

5 a radio receiver for receiving a multiple
frequency ranging signal from a first satellite and a
further ranging signal from a second satellite;

deriving means for deriving first ionospheric
delay data from said multiple frequency ranging
signal; and

10 estimating means for estimating second
ionospheric delay data for the further ranging signal
on the basis of said first ionospheric delay data.

2. Apparatus as claimed in claim 1, further
comprising data receiving means for receiving
15 ionospheric data, said estimating means being operable
to estimate the second ionospheric delay data
additionally on the basis of said ionospheric data.

3. Apparatus as claimed in claim 2, wherein
said data receiving means is arranged to receive said
20 ionospheric data from a satellite.

4. Apparatus as claimed in claim 2 or 3,
wherein said ionospheric data represents a plurality
of ionospheric delay values corresponding to a
plurality of spatially separated points.

25 5. Apparatus as claimed in any preceding claim,
wherein said estimating means includes modelling means
for generating a model of spatial variation of

ionospheric delay on the basis of said first ionospheric delay data, said estimating means being operable to estimate said second ionospheric delay data on the basis of said model.

5 6. Apparatus as claimed in claim 5 when dependent on claim 2, wherein said modelling means is operable to generate said model on the basis of said ionospheric data.

10 7. Apparatus as claimed in claim 5 or claim 6, wherein said model comprises a function which is variable in accordance with one or more parameters, said modelling means being arranged to calculate said one or more parameters such that said function is fitted to said first ionospheric delay data.

15 8. Apparatus as claimed in claim 7 when dependent on claim 6, wherein said modelling means is arranged to calculate said one or more parameters such that said function is additionally fitted to said ionospheric data.

20 9. A method of satellite radiodetermination, comprising receiving a multiple frequency ranging signal from a first satellite;

receiving a further ranging signal from a second satellite, deriving first ionospheric delay data from
25 said multiple frequency ranging signal; and

estimating second ionospheric delay data for the further ranging signal on the basis of said first

ionospheric delay data.

10. A satellite payload adapted for a satellite designed for a non-geostationary orbit, comprising:

a clock for generating a time signal;

5 a ranging signal generator for generating a ranging signal including timing data derived from said time signal;

relaying means for retransmitting data received by the satellite from a ground station; and

10 means for selectively activating and deactivating said relaying means independently of the activation of the ranging signal generator.

11. A satellite payload adapted for a satellite designed for a non-geostationary orbit, comprising:

15 a clock for generating a time signal;

a ranging signal generator for generating a ranging signal including timing data derived from said time signal;

relaying means for retransmitting received data received by the satellite from a ground station;

20 means for detecting an absence of said received data; and

means for generating dummy data for transmission in response to detection of said absence.

25 12. Apparatus for providing augmentation data for transmission by a satellite, comprising:

means for receiving the augmentation data;

means for providing position data relating to the position of the satellite;

determining means for determining whether the position data satisfies a predetermined criterion; and

5 means for selectively enabling output of said augmentation data for transmission to said satellite in response to the determining means.

13. A method of providing augmentation data for transmission by a satellite, comprising:

10 providing position data relating to the position of the satellite;

determining whether the position data satisfies a predetermined criterion; and

15 selectively enabling output of said augmentation data for transmission to a satellite in response to the result of said determining step.

14. Satellite radiodetermination apparatus, comprising:

20 means for receiving a plurality of ranging signals from a corresponding plurality of satellites; and

25 means for receiving ionospheric delay data, the apparatus being arranged to perform radiodetermination on the basis of said plurality of ranging signals and selectively on the basis of said ionospheric delay data in response to authorization data provided at said apparatus.

15. Apparatus as claimed in claim 14, further including means for receiving differential correction data which is substantially independent of ionospheric delay, wherein said apparatus is arranged to perform radiodetermination additionally on the basis of said differential correction data.

16. Apparatus as claimed in claim 14 or claim 15, wherein said ionospheric delay data is encrypted, and said apparatus includes decryption means for decrypting said ionospheric delay data in response to said authorization data.

17. Apparatus as claimed in any one of claims 14 to 16, including input means for inputting said authorization data.

18. Apparatus for providing augmentation data for transmission via a satellite, comprising:

means for receiving said augmentation data which includes unencrypted ionospheric delay data and unencrypted differential correction data which is substantially independent of ionospheric delay;

means for encrypting said ionospheric delay data; and

means for outputting said encrypted ionospheric delay data and said unencrypted differential correction data for transmission via said satellite.

19. A method of providing ionospheric delay data and differential correction data which is

substantially independent of ionospheric delay for transmission via a satellite, comprising:

receiving said ionospheric delay data and said differential correction data in an unencrypted form;

5 encrypting said ionospheric delay data; and

outputting said encrypted ionospheric delay data and said unencrypted differential correction data for transmission via said satellite.

20. Satellite radiodetermination apparatus,
10 comprising:

means for receiving a plurality of ranging signals from a corresponding plurality of satellites;

means for receiving ionospheric delay data; and

15 means for receiving residual error data relating to residual errors in said ionospheric delay data, said satellite radiodetermination apparatus being arranged to perform radiodetermination on the basis of said plurality of ranging signals, said ionospheric delay data and said residual error data.

20 21. Apparatus as claimed in claim 20, wherein said residual error information includes error bound information relating to the error bounds of said ionospheric delay information.

25 25. Apparatus for determining residual errors in a satellite radiodetermination system, comprising:

means for receiving a plurality of ranging signals from a plurality of satellites;

means for receiving ionospheric delay data and differential correction data relating to errors in said ranging signals which are independent of ionospheric delay;

5 calculating means for calculating a position or time on the basis of said ranging signals corrected on the basis of said differential correction data and said ionospheric delay data; and

10 error calculating means for calculating errors in said ionospheric delay data on the basis of the difference between said calculated position or time and a predetermined reference position or time.

23. Apparatus as claimed in claim 22, wherein said means for receiving said ranging signals
15 comprises a dispersed plurality of receiving stations, said calculating means being arranged to calculate a plurality of positions corresponding respectively to said receiving stations, and said error calculating means being arranged to calculate said errors on the
20 basis of the respective differences between said calculated positions and predetermined positions corresponding to said receiving stations.

24. A satellite radiodetermination receiver including apparatus as claimed in any one of claims 1
25 to 8, 14 to 17, 20 and 21.

25. A terrestrial station including apparatus as claimed in any one of claims 12, 18, 22 or 23.

26. A satellite including a satellite payload as claimed in claim 10 or 11.

27. A satellite radiodetermination system including a plurality of satellite radiodetermination receivers as claimed in claim 24 and at least one
5 terrestrial station as claimed in claim 25.